IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

22077305

MATHEMATICS
STANDARD LEVEL
PAPER 1

Monday 7 May 2007 (afternoon)

1 hour 30 minutes

Candidate session number

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all the questions in the spaces provided.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.

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Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working. Working may be continued below the lines, if necessary.

1.   The population of a city at the end of 1972 was 250 000 . The population increases by 1.3 % per year.

   (a)   Write down the population at the end of 1973.

   (b)   Find the population at the end of 2002.

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2. One of the terms of the expansion of $(x+2y)^{10}$ is ax^8y^2. Find the value of a.

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3. Let $f(x) = \sqrt{x+4}$, $x \geq -4$ and $g(x) = x^2$, $x \in \mathbb{R}$.

(a) Find $(g \circ f)(3)$.

(b) Find $f^{-1}(x)$.

(c) Write down the domain of f^{-1}.

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4.   The eye colour of 97 students is recorded in the chart below.

	Brown	Blue	Green
Male	21	16	9
Female	19	19	13

One student is selected at random.

(a)   Write down the probability that the student is a male.

(b)   Write down the probability that the student has green eyes, given that the student is a female.

(c)   Find the probability that the student has green eyes or is male.

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5. Let $f'(x) = 12x^2 - 2$.

Given that $f(-1) = 1$, find $f(x)$.

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6.   Consider the vectors $u = 2i + 3j - k$ and $v = 4i + j - pk$.

   (a)   Given that u is perpendicular to v find the value of p.

   (b)   Given that $q|u| = 14$, find the value of q.

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Turn over

7. Let $A = \begin{pmatrix} 1 & x & -1 \\ 3 & 1 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 3 \\ x \\ 2 \end{pmatrix}$.

(a) Find AB.

(b) The matrix $C = \begin{pmatrix} 20 \\ 28 \end{pmatrix}$ and $2AB = C$. Find the value of x.

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8. The weights of a group of children are normally distributed with a mean of 22.5 kg and a standard deviation of 2.2 kg.

(a) Write down the probability that a child selected at random has a weight more than 25.8 kg.

(b) Of the group 95 % weigh less than k kilograms. Find the value of k.

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(c) The diagram below shows a normal curve.

On the diagram, shade the region that represents the following information:

87 % of the children weigh less than 25 kg

Turn over

9. The velocity, v, in ms^{-1} of a particle moving in a straight line is given by $v = e^{3t-2}$, where t is the time in seconds.

(a) Find the acceleration of the particle at $t = 1$.

(b) At what value of t does the particle have a velocity of $22.3\ ms^{-1}$?

(c) Find the distance travelled in the first second.

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10. A set of data is

18, 18, 19, 19, 20, 22, 22, 23, 27, 28, 28, 31, 34, 34, 36.

The box and whisker plot for this data is shown below.

A   B   C   D   E

(a) Write down the values of A, B, C, D and E.

A = ...   B = ...   C = ...   D = ...   E = ...

(b) Find the interquartile range.

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11. The following diagram shows a sector of a circle of radius r cm, and angle θ at the centre. The perimeter of the sector is 20 cm.
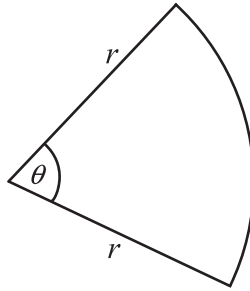
(a) Show that $\theta = \dfrac{20-2r}{r}$.

(b) The area of the sector is 25 cm^2. Find the value of r.

12. Consider two different quadratic functions of the form $f(x) = 4x^2 - qx + 25$. The graph of each function has its vertex on the x-axis.

(a) Find both values of q.

(b) For the greater value of q, solve $f(x) = 0$.

(c) Find the coordinates of the point of intersection of the two graphs.

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Turn over

13. Let $f(x) = \ln(x+2)$, $x > -2$ and $g(x) = e^{(x-4)}$, $x > 0$.

(a) Write down the *x*-intercept of the graph of f.

(b) (i) Write down $f(-1.999)$.

   (ii) Find the range of f.

(c) Find the coordinates of the point of intersection of the graphs of f and g.

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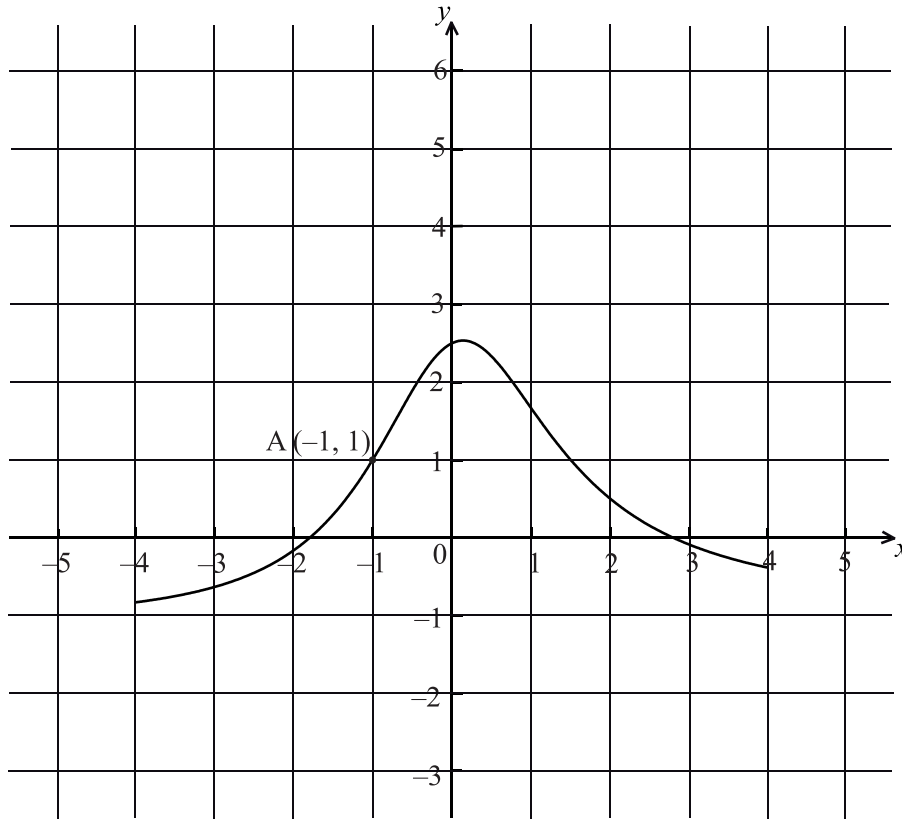
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14. The graph of a function f is shown in the diagram below. The point A$(-1, 1)$ is on the graph, and $y = -1$ is a horizontal asymptote.

(a)   Let $g(x) = f(x-1) + 2$. On the diagram, sketch the graph of g.

(b)   Write down the equation of the horizontal asymptote of g.

(c)   Let A$'$ be the point on the graph of g corresponding to point A. Write down the coordinates of A$'$.

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15. Let $f(x) = 3\cos 2x + \sin^2 x$.

(a) Show that $f'(x) = -5\sin 2x$.

(b) In the interval $\dfrac{\pi}{4} \le x \le \dfrac{3\pi}{4}$, one normal to the graph of f has equation $x = k$.
Find the value of k.

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